

## High School Earth and Space Science, Semester B

### Course Overview

Earth and space science is the study of the structure of our planet and Earth's role in the solar system and universe. This branch of science relies on observations, historical data, and physical evidence to describe the natural processes that occur around us and in distant space. You'll begin Semester B by comparing the composition of rocks and minerals and analyzing the processes involved in the rock cycle. You'll explore the tectonic mechanisms that lead to some of Earth's most prominent geological features. Next, you'll study important interactions between the hydrosphere and atmosphere and the role they play in weathering and erosion. You'll also differentiate between weather and climate and make evidence-based predictions about both using data and modeling. The last unit in this course highlights the negative effects that humans can have on the natural cycles of Earth, as well as effective measures we can take to protect our planet.

### Course Goals

By the end of this course, you will be able to do the following:

- Compare rocks and minerals and explain their properties and characteristics.
- Model Earth's surface as a system of moving plates to explain the phenomena of continental drift and seafloor spreading.
- Analyze the history of a region using topographic maps and satellite photos.
- Demonstrate how the processes of weathering and erosion can affect human environments.
- Explain how the atmosphere interacts with other subsystems of Earth.
- Make predictions about future weather phenomena based on observations of current conditions.
- Analyze the factors that drive Earth's climate.
- Study the discovery, extraction, uses, and disposal of natural resources.
- Explain the effect of natural disasters on human populations.
- Describe the causes of pollution in Earth's fluid subsystems.
- Use models and mathematics to forecast the effects of climate change on Earth's ecosystems.

## General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word-processing software, such as Microsoft Word or Google Docs.
- Understand the basics of spreadsheet software, such as Microsoft Excel or Google spreadsheets, but prior computing experience is not necessary.
- Perform online research using various search engines and library databases.
- Communicate through email and participate in discussion boards.

*For a complete list of general skills that are required for participation in online courses, refer to the Prerequisites section of the Student Orientation document, found at the beginning of this course.*

## Credit Value

High School Earth and Space Science B is a 0.5-credit course.

## Course Materials

- computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent
- Microsoft PowerPoint or equivalent
- materials listed in Appendix B (Appendix C provides a detailed breakdown of these materials by activity.)

## Course Pacing Guide

This course description and pacing guide is intended to help you stay on schedule with your work. Note that your course instructor may modify the schedule to meet the specific needs of your class.

## Unit 1: The Solid Earth

### Summary

You'll begin this unit by examining and comparing the appearance and composition of rocks and minerals. You'll also describe how rocks continually change through the rock cycle. Then you'll learn about convection currents and tectonic activity inside Earth that are responsible for the formation of Earth's geologic features. You'll use tectonic theories to explain the phenomena of continental drift, seafloor spreading and the origin

of Earth's magnetic field. Near the end of the unit, in a hands-on activity, you'll analyze the geological history of a region using topographic maps and satellite photographs.

Day	Activity/Objective	Type
1 day: 1	<b>Syllabus and Student Orientation</b> <i>Review the Student Orientation and Course Syllabus at the beginning of this course.</i>	Course Orientation
3 days: 2–4	<b>Rocks and Minerals</b> <i>Examine a wide variety of rocks and minerals and formulate a scientific explanation for the variety of compositions that exist.</i>	Course Activity
3 days: 5–7	<b>Earth's Materials</b> <i>Compare rocks and other materials that cycle through Earth's crust and describe how they appear to observers on Earth's surface.</i>	Lesson
4 days: 8–11	<b>Plate Tectonics</b> <i>Model Earth's surface as a system of moving plates to explain the phenomena of continental drift and seafloor spreading.</i>	Lesson
4 days: 12–15	<b>Tectonic Mechanisms</b> <i>Identify where the energy for tectonic movement comes from and explain how mantle convections give rise to Earth's magnetic field.</i>	Lesson
4 days: 16–19	<b>Topographic Maps and Satellite Photographs</b> <i>Use topographic maps and satellite photographs to formulate the geological history of a region.</i>	Course Activity
4 days: 20–23	<b>Tectonic Features and Phenomena</b> <i>Explain how certain geographic and geologic features form as a direct result of tectonic activity.</i>	Lesson

Day	Activity/Objective	Type
4 days: 24–27	<b>Unit Activity and Discussion—Unit 1</b>	Unit Activity/ Discussion
1 day: 28	<b>Posttest—Unit 1</b>	Assessment

## Unit 2: The Fluid Earth

### Summary

In this unit, you'll focus on the interactions of the subsystems of Earth: hydrosphere, atmosphere, biosphere, and geosphere. You'll begin by modeling how Earth's hydrosphere (water) interacts with the other subsystems. In a hands-on activity, you'll demonstrate the processes of weathering and erosion and their impact on society. You'll also create models to analyze the role of fluids in the formation of the geosphere and identify changes in Earth's atmosphere since it first formed. Near the end of the unit, you'll differentiate between the phenomena of weather and climate, and you'll complete an activity in which you'll predict the weather using current weather data and regional maps.

Day	Activity/Objective	Type
4 days: 29–32	<b>The Hydrosphere</b> <i>Analyze the behavior of Earth's hydrosphere and model how it interacts with Earth's other subsystems.</i>	Lesson
4 days: 33–36	<b>Weathering and Erosion</b> <i>Build a model that demonstrates how the processes of weathering and erosion can affect human environments.</i>	Course Activity
4 days: 37–40	<b>Fluids and the Formation of Earth's Features</b> <i>Create physical and conceptual models to represent how fluids can form features in the geosphere.</i>	Lesson

Day	Activity/Objective	Type
4 days: 41–44	<b>The Atmosphere</b> <i>Analyze data to identify changes in Earth's atmosphere since its formation and explain how the atmosphere interacts with other subsystems.</i>	Lesson
4 days: 45–48	<b>Observing and Predicting Weather</b> <i>Make predictions about future weather phenomena based on observations of current conditions.</i>	Course Activity
4 days: 49–52	<b>Weather</b> <i>Describe different types of weather and model how different factors, including subsystem interactions, can contribute to the formation of weather phenomena.</i>	Lesson
4 days: 53–56	<b>Climate</b> <i>Analyze the factors that drive Earth's climate and use evidence to predict climatic changes that are likely to occur in the future.</i>	Lesson
5 days: 57–61	<b>Unit Activity and Discussion—Unit 2</b>	Unit Activity/ Discussion
1 day: 62	<b>Posttest—Unit 2</b>	Assessment


## Unit 3: Human Interactions

### Summary

In this unit, you'll study the discovery, extraction, uses, and disposal of natural resources. You'll compare the costs of energy resources and predict the negative impacts that human activity can have on the natural cycles of Earth. You'll also describe the causes of pollution in Earth's fluid subsystems and propose cost-effective methods for mitigating pollution. Finally, you'll use models and mathematics to forecast the effects of climate change on Earth's ecosystems.

Day	Activity/Objective	Type
4 days: 63–66	<b>Earth's Resources</b> <i>Identify natural resources that humans use and examine how discovery, extraction, uses, and disposal of those resources affects Earth's subsystems and humanity at large.</i>	Lesson
4 days: 67–70	<b>Comparing Energy Resources</b> <i>Compare energy resources that can be extracted from Earth in terms of cost, risks, and benefits.</i>	Course Activity
4 days: 71–74	<b>Human Interactions with Earth's Subsystems</b> <i>Explain how natural disasters affect human populations and predict how human activity will negatively influence the natural cycles of Earth.</i>	Lesson
4 days: 75–78	<b>Pollution in the Fluid Subsystems</b> <i>Describe the causes of pollution in Earth's fluid subsystems and evaluate small-scale mitigation practices in terms of cost and effectiveness.</i>	Course Activity
4 days: 79–82	<b>Global Climate Change</b> <i>Use models and mathematics to forecast the effects of climate change on Earth's ecosystems.</i>	Lesson
5 days: 83–87	<b>Unit Activity and Discussion—Unit 3</b>	Unit Activity/ Discussion
1 day: 88	<b>Posttest—Unit 3</b>	Assessment
1 day: 89	<b>Semester Review</b>	
1 day: 90	<b>End-of-Semester Exam</b>	Assessment

## Appendix A: Safety Notes and Disclaimer

Each Course Activity and Unit Activity that includes a lab or experiment component will highlight key safety guidelines using the safety icon () , which appears directly in the activity. In addition to adhering to those guidelines, you must ensure that you follow these general safety practices:

- Work slowly and safely at all times, and abide by the safety notes and icons.
- Pay attention and be alert at all times. Limit any distractions.
- Keep your hands away from your nose, eyes, mouth, and other skin. Wash your hands before and after experiments.
- If you don't understand something, ask a teacher or an adult before proceeding.
- Wear the required protective gear.
- Adult supervision is required for all activities involving an experiment or lab component.
- Do not perform experiments that have not been approved. Follow the procedures.
- Follow good housekeeping practices. Keep your work area clean.
- Abide by all disposal instructions and icons to protect yourself and our planet.
- Report any problems or complications to an adult.

**Note:** *Edmentum assumes no liability for personal injury, death, property damage, equipment damage, or financial loss resulting from the instruction included in this course.*

## Appendix B: Course Lab Materials (Semesters A and B)

### Household Materials – Basic

The italicized materials listed below are available as a convenience in the *Edmentum Earth and Space Science Kit*

- paper or poster board (standard letter size: 8.5 inches x 11 inches)
- pen, pencil, or fine-tip marker
- scissors
- ruler with English and metric scales
- toilet paper
- paper towels
- plastic spoon
- plastic bowl
- rubber band
- aluminum foil
- string, fishing line, or dental floss (at least 2 meters or 6 feet)
- sticky notes, or paper and tape
- 2 soft rags
- squeezable water bottle with sport cap
- 2 large glass beakers, glasses, or jars (250 to 500 milliliters or 8 to 16 ounces)
- large, transparent glass or plastic container (such as a pitcher)
- small, transparent glass beaker or jar (such as a baby food jar)
- small glass or jar (250 milliliters or 6 to 8 ounces)
- measuring cup (able to measure  $\frac{1}{4}$  cup)
- measuring spoons: 1 teaspoon and 1 tablespoon
- 2 one-gallon jugs or pitchers
- bucket or trash can
- water from a natural water source such as a pond, stream, or well
- tap water
- distilled water (at least 100 milliliters, or about 4 ounces)
- white vinegar (at least 100 milliliters, or about 4 ounces)
- baking soda
- dry bar of soap
- sand
- 2 rocks (at least 1.5 inches or 4 centimeters in size.)
- calculator (optional)
  
- *iron nail*



### Household Materials – Less Common

The italicized materials listed below are available as a convenience in the *Edmentum Earth and Space Science Kit*

- stopwatch (could be a mobile app or on a computer)
- lamp with 150-watt incandescent bulb (or access to a sunny area)
- apron
- compass used to draw circles (optional)
- paintbrush, 1 inch or less in width
- plastic paint tray liner (or a stream table)
- 2 empty plastic soda bottles (2 liters each)
- modeling clay
- copper penny (dated 1982 or older)
- wooden blocks (approximately 2 inches thick)
- 4 to 5 toy building blocks or game pieces (anything that resembles a tiny model house)
  
- *disposable gloves*
- *safety goggles*
- *small magnet*
- *magnetic compass*
- *2 thermometers, continuous measurement; must measure up to 120° Fahrenheit (50° Celsius)*
- *2 cups dry plaster of Paris*
- *petroleum jelly*
- *food coloring*

### **Specialized Science Materials**

All materials listed below are available in the *Edmentum Earth and Space Science Kit*.

- *scale with at least 0.1 gram accuracy*
- *magnifying hand lens*
- *graduated cylinder, 100 or 250 milliliters*
- *limestone chips (50 grams total)*
- *mineral kit (including apatite, calcite, fluorite, graphite, gypsum, magnetite, feldspar, microcline, pyrite, quartz, and talc)*
- *porcelain streak plate*
- *glass streak plate*
- *water quality test kit, including test strips for pH and total alkalinity, total hardness, nitrate/nitrite, nitrite-nitrogen, iron (Fe+2/Fe+3), copper (Cu+1/Cu+2), free and total chlorine*
- *4 2-ounce plastic jars (may use clear, clean glass baby food jars)*
- *a bivalve shell (may use a “household” item to fossilize, such as a leaf or a chicken bone)*
- *binoculars (optional)*

## Appendix C: Lab Materials by Activity (Semester B)

The italicized materials listed below are available in the *Edmentum Earth and Space Science Kit*.

Unit	Activity Name	Task	Equipment List
B1	Course Activity: Rocks and Minerals  <b>* <i>Special lab materials required. (Edmentum Earth and Space Science Kit or school-provided lab materials)</i></b>	Task 1: Mineral Identification	<p>Italicized items may be found in the <i>Edmentum Earth and Space Science Kit's</i> bags labeled "Rocks and Minerals" and "Common Materials."</p> <ul style="list-style-type: none"> <li>• <i>mineral kit (including apatite, calcite, fluorite, graphite, gypsum, magnetite, feldspar/microcline, pyrite, quartz, and talc)</i></li> <li>• <i>porcelain streak plate</i></li> <li>• <i>glass streak plate</i></li> <li>• <i>iron nail</i></li> <li>• <i>small magnet</i></li> <li>• <i>scale (with an accuracy of at least 0.1 grams)</i></li> <li>• <i>graduated cylinder (100-milliliter or 250-milliliter)</i></li> <li>• <i>magnifying hand lens (optional)</i></li> <li>• water</li> <li>• copper penny (dated 1982 or older)</li> </ul>
		Task 2: Characteristics of Rocks	<ul style="list-style-type: none"> <li>• <i>magnifying hand lens</i></li> <li>• 2 rocks (at least 1.5 inches or 4 centimeters in size and access to an outdoor area to collect them)</li> </ul>
B1	Course Activity: Topographic Maps and Satellite Photos	Task 1: Constructing and Analyzing a Topographic Map	<ul style="list-style-type: none"> <li>• lump of modeling clay (approximately 5 to 6 inches in diameter)</li> <li>• string (fishing line or dental floss works best)</li> <li>• ruler</li> <li>• pencil</li> <li>• 8.5 x 11-inch piece of paper</li> </ul>

Unit	Activity Name	Task	Equipment List
B1	Unit Activity: The Solid Earth	Task 1: Modeling Earth's Convection Currents	<p>Italicized items are found in the <i>Edmentum Earth and Space Science Kit</i>.</p> <ul style="list-style-type: none"> <li>• <i>food coloring</i></li> <li>• large, transparent glass or plastic container (such as a pitcher)</li> <li>• small, transparent glass beaker or jar (such as a baby food jar)</li> <li>• hot and cold tap water</li> <li>• aluminum foil</li> <li>• rubber band</li> <li>• 5 to 10 small pieces of paper, approximately 2 centimeters by 2 centimeters</li> <li>• pencil with a sharp point</li> </ul>
B2	<p>Course Activity: Weathering and Erosion</p> <p><b>* <i>Special lab materials required. (Edmentum Earth and Space Science Kit or school-provided lab materials)</i></b></p>	Task 1: Weathering Caused by Precipitation	<p>Italicized items are found in the <i>Edmentum Earth and Space Science Kit</i>.</p> <ul style="list-style-type: none"> <li>• <i>scale or balance with at least +/- 0.1 gram accuracy</i></li> <li>• dry bar of soap</li> <li>• sink and faucet</li> <li>• stopwatch</li> </ul>
		Task 2: Modeling River Erosion	<ul style="list-style-type: none"> <li>• <i>safety goggles</i></li> <li>• plastic paint tray liner (or a stream table)</li> <li>• sand</li> <li>• squeezable water bottle with sport cap</li> <li>• wooden blocks (approximately 2 inches thick) to make the base of the paint tray more level, or equivalent</li> <li>• 4 to 5 toy building blocks or game pieces to use as tiny model houses</li> <li>• paper towels</li> <li>• bucket, large container, or trash can to collect the excess water</li> <li>• string, fishing line, or dental floss (approximately 3 feet)</li> <li>• ruler with English and metric scales</li> <li>• pen or pencil</li> </ul>

Unit	Activity Name	Task	Equipment List
B3	Unit Activity: Human Interactions  <b>* <i>Special lab materials required. (Edmentum Earth and Space Science Kit or school-provided lab materials)</i></b>	Task 1: Analyze and Compare Water Sources	Italicized items are found in the <i>Edmentum Earth and Space Science Kit's</i> bag labeled "Human Interactions." <ul style="list-style-type: none"> <li>• <i>water quality test kit, including test strips for pH and total alkalinity, total hardness, nitrate/nitrite, nitrite-nitrogen, iron (Fe+2/Fe+3), copper (Cu+1/Cu+2), and free and total chlorine</i></li> <li>• 2 water-testing containers such as large glass beakers, glasses, or jars (250 to 500 milliliters or 8 to 16 ounces)</li> <li>• 2 one-gallon jugs or pitchers</li> <li>• tap water from a sink or water fountain</li> <li>• water from a natural water source such as a pond, stream, or well</li> </ul>